

Mark Scheme (Results) Summer 2007

GCE

GCE Chemistry (6241) Paper 01

General Guidance on Marking

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge.

Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Using the mark scheme

The mark scheme gives you:

- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

- 1 / means that the responses are alternatives and either answer should receive full credit.
- 2 () means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
- 3 [] words inside square brackets are instructions or guidance for examiners.
- 4 Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
- 5 ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

6241/01

	EXPECTED ANSWER	ACCEPT	REJECT	MARK
1.	(a) ${}^{79}_{35}\text{Br}$: 44 neutrons (1) ${}^{81}_{35}\text{Br}$: 35 protons(1) ${}^{81}_{35}\text{Br}^-$: 36 electrons(1)			(3)
	(b) Na $2s^2 2p^6 3s^1$ (1) Br $2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^5$ (1) Ignore repeat of $1s^2$	Allow subscripts and ignore capital letters Allow $4s^2 3d^{10} 4p^5$ Allow p as $p_x p_y p_z$ with 2 in each		(2)
	(c) They have the same (number of protons and) electron(ic) configuration Same (number of protons and)electronic structure Same (number of protons and)electron arrangement same (number of protons and)number of electrons MUST MENTION ELECTRONS		'Just' Same number of protons 'Just' same number of electron shells same number of outer electrons same number of electrons in outer shell Correct answer followed by reference to outer shell scores (0)	(1)
	(d) Mass spectrometer	Allow variations of spelling	Mass spec	(1)
	(e) $\frac{(78.93 \times 50.54) + (80.91 \times 49.46)}{100}$ (1) = 79.91(1) 2 nd mark consequential on transcription error data used Correct answer with no working scores 2 Answer to 4 S.F. with <u>NO</u> units but allow g/mol			(2)

	EXPECTED ANSWER	ACCEPT	REJECT	MARK
(f)	<p><i>Between the atoms:</i> Covalent(1)</p> <p><i>Between the molecules :</i> Induced dipole-(induced) dipole OR dispersion OR London OR van der Waals OR instantaneous OR Temp dipole - (1) (forces)</p>	Variations on van der Waals such as de and walls, vdW	Dipole-dipole OR 'JUST' intermolecular forces ID-ID	(2)
(g)	Brown OR orange OR red	Any combination of these colours		(1)
(h)	Yellow OR Orange OR any combination IGNORE words such as 'bright' or 'persistent' or 'lasting' or 'golden' or 'intense'			(1)
(i)	$2\text{Na} + \text{Br}_2 \rightarrow 2\text{NaBr}$ 1 mark for balanced equations IGNORE state symbols	$\frac{1}{2}$ or multiple $2\text{Na}^+\text{Br}^-$ For 2NaBr	$\text{Na}^+ + \text{Br}^-$	(1)
(j)	Metallic		Metal	(1)
(k)	<p>Ionic / electrovalent(1)</p> <p>$[\text{Na}]^+ [:\text{Br}:]^-$ OR $[:\text{Na}:]^+ [:\text{Br}:]^-$</p> <p>1 mark for correct charges</p> <p>1 mark for electrons Penalise wrong symbol only once Allow dots or crosses If choose to give inner shell electrons they must be correct</p>	<p>Charge could be on central atom e.g. Na^+ $[]$ not necessary If charges omitted can score electrons mark provided not covalent i.e. sig gap between Na & Br Arrow to show transfer of an electron on its own does not score as this does not answer the question</p>	Anything that looks covalent scores zero.	(3)
Question total 18 marks				

	EXPECTED ANSWER			ACCEPT	REJECT	MARK
2	(a)	(i)	$4\text{LiNO}_3 \rightarrow 2\text{Li}_2\text{O} + 4\text{NO}_2 + \text{O}_2$ Species (1) Balance(1) Not stand alone conditional on correct species	Or fractions/ multiples		(2)
		(ii)	$2\text{CsNO}_3 \rightarrow 2\text{CsNO}_2 + \text{O}_2$ Correct balanced equation	Or fractions/ multiples		(1)
	(b)	(i)	There must be a comment about both barium and calcium to score both marks Barium would react to produce a (colourless)/(clear) solution does not give a ppt./ clear (1) Calcium would go cloudy /give (white) ppt. (1) E.g. Calcium would go cloudy but barium (goes) clear (2)	Allow Ba and Ca in argument Barium hydroxide dissolves	Goes colourless Other colours	(2)
		(ii)	Insoluble/ solid/layer / coating of barium sulphate formed (1) allow equn with $\text{BaSO}_4(\text{s})$ Must say what the coating is since question says use information in table Which prevents acid getting to surface (of barium) (1) 2 nd mark conditional on 1 st need some idea that a substance is formed that generates a barrier to further reaction	If candidate uses word ppt must be clear that this is on the surface of the barium or causes interference	BaSO_4 unreactive Barium disappears Any reference that implies barium all used up or was a very small piece or acid not in excess or reaction over scores zero References to other layers such as oxide/hydroxide	(2)
	(c)		Insoluble			(1)
	(d)		$\text{Ca}(\text{s}) + 2\text{H}^+(\text{aq}) \rightarrow \text{Ca}^{2+}(\text{aq}) + \text{H}_2(\text{g})$ 1 mark for equation 1 mark for state symbols	state symbol mark for correct molecular equation $\text{Ca}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2(\text{aq}) + \text{H}_2(\text{g})$ (g) Scores (1)		(2)
Question total 10 marks						

	EXPECTED ANSWER			ACCEPT	REJECT	MARK
3	(a)	(i)	Enthalpy/heat/ energy required/change to remove 1 electron(1) from each of one mole(1) of gaseous atoms (of an element)(1) Ignore references to gaseous electrons	$X(g) \rightarrow X^+(g) + e$ 2 marks for the change and the state but not the mol Isolated atoms in place of gaseous	If incorrect equation given after correct def -1 mark	(3)
		(ii)	$O^+(g) \rightarrow O^{2+}(g) + e^{(-)}$ Or $O^+(g) - e^{(-)} \rightarrow O^{2+}(g)$ State symbols required		E (for element) in place of O	(1)
	(b)	(i)	There is a large increase after the removal of 6 electrons(1) (Group) 6 (1) Stand alone (Need to look at diagram for annotation)	Large increase before removal of 7 th electron (Big) jump between 6 and 7		(2)
		(ii)	Sulphur / S / S ₈ Not CQ			(1)
	(c)		S ₈ ⁺ 1 mark 'S ₈ ' 1 mark '+' Stand alone	³² S ₈ ⁺		(2)
Question total 9 marks						

			EXPECTED ANSWER	ACCEPT	REJECT	MARK
4	(a)	(i)	<p><i>Answer must identify ions as sodium ions / Na⁺ and chloride / Cl⁻</i></p> <p><i>Answer must describe structure.</i></p> <p><i>Ignore any references to the bonding.</i></p> <p>Examples 6 sodium ions / Na⁺ around each chloride ion (1) and 6 chloride ions /Cl⁻ around each sodium ion (1)</p> <p>OR Cubic structure(1) With alternating sodium and chloride ions (1)</p> <p>OR Two interlocking <u>cubic</u> lattices(1) of sodium and chloride ions(1)</p> <p>OR Cube (1) With alternating sodium and chloride ions(1)</p> <p>OR Cubic lattice (1) With alternating sodium and chloride ions(1)</p> <p>OR 6:6 co-ordinate lattice(1) of sodium and chloride ions(1)</p>	<p>A correctly labelled diagram to support text for both marks</p> <p>A diagram showing just Na⁺ & Cl⁻ can score 1 mark</p> <p>Reference to oppositely charged ions without saying what they are scores max 1</p> <p>If diagram drawn ignore relative sizes</p>	<p>Any mention of atoms loses the mark that relates to ions</p> <p>Any reference to covalency loses the mark that relates to ions</p> <p>Chlorine ions</p> <p>Closely packed does not mean cubic</p>	(2)
		(ii)	<p>Layers/Planes/Sheets (1)</p> <p>(interlocking) hexagons of carbon atoms (in which each carbon bonded to three other carbon atoms) (1)</p> <p>nb Hexagonal layers of carbon atoms (2)</p>	<p>Correct labelled diagram to support text for both marks</p> <p>Discussion based on electrons being sp² hybridised</p>	<p>Max 1 mark if bonding between layers wrongly identified</p> <p>Ref to any number other than 3 scores 1 max</p>	(2)

	EXPECTED ANSWER		ACCEPT	REJECT	MARK
	(b)	Weak /induced dipole-(induced) dipole/ dispersion/ London/ van der Waals forces between layers(1) Allows layers to slide over each other /layers break off(on to the paper) (1) Stand alone mark		Wrong intermolecular forces e.g. Hydrogen bond	(2)
	(c)	(i)	(in molten sodium chloride, (Na ⁺ and Cl ⁻)) ions can move (to carry current)	Not just ions move Not NaCl ions Free electrons Mobile electrons Sea of electrons Delocalised ions/electrons	(1)
		(ii)	electrons can move		(1)
					Question total 8 marks

	EXPECTED ANSWER		ACCEPT	REJECT	MARK
5	(a)	Any statement that means the number gets less Eg Decrease (in oxidation number of an element) Reduction of ON Lowering of ON ON becomes more negative ON becomes less positive		'Just' Gain of electrons	(1)
	(b)	(i) $2\text{NaBr} + 3\text{H}_2\text{SO}_4 \rightarrow 2 \text{NaHSO}_4 + \text{SO}_2 + \text{Br}_2 + 2\text{H}_2\text{O}$ OR $2\text{NaBr} + 3\text{H}_2\text{SO}_4 \rightarrow 2 \text{NaHSO}_4 + \dots\text{SO}_2 + \dots \text{Br}_2 + 2\text{H}_2\text{O}$ OR $2\text{NaBr} + 3\text{H}_2\text{SO}_4 \rightarrow 2 \text{NaHSO}_4 + 1\text{SO}_2 + 1\text{Br}_2 + 2\text{H}_2\text{O}$			(1)
		(ii) H_2SO_4 : +6 / 6 / VI / 6+ HSO_4^- : +6 / 6/ VI / 6+ SO_2 : +4/4/IV / 4+ H_2S : -2 / -II / 2- All four correct 2 marks Any 3 correct 1 mark		Superscript + e.g S^{6+}	(2)
		(iii) Change in ON of S increases down (halide) group (1) Link all three changes to actual numbers with halide (1) Consequential on answers to part(ii)	Correct answer referring to only two halides scores 1 mark	If ref to halogens lose second mark	(2)
Question total 6 marks					

	EXPECTED ANSWER		ACCEPT	REJECT	MARK
6	(a)	The number of atoms in 12g of ^{12}C (2) The number of atoms in 1 mole of ^{12}C (2)	Number of atoms in 1 mole (1) of atoms / stated monatomic substance (1) OR Number of molecules in 1 mole (1) of molecules / stated molecular substance (1) OR Number of electrons in 1 mole (1) of electrons (1) OR Number of particles in 1 mole (1) max	If answer just quotes the number it does not score it is in the question. Number of particles in 1 mole of a substance	(2)
	(b)	(i) 1.907 g of Z contains 2.87×10^{22} $1.907 \times 6.02 \times 10^{23} / 2.87 \times 10^{22}$ is 1 mol(1) = 40.(0) (1) No units but allow 40 g/mol IGNORE s.f. in answer Allow 39.7 for 2 marks this is rounding 0.04767 to 2 sig figs in calc Allow 38.14 for 1 mark as this is rounding to 1 sig fig. Correct answer with some working (2)	Moles of Z = $2.87 \times 10^{22} / 6.02 \times 10^{23}$ = (0.04767) (1) Atomic mass = 1.907/moles = 40.(0) (1)		(2)
		(ii) Ar / Argon Consequential on (i) but must be nearest group 0			(1)

	EXPECTED ANSWER		ACCEPT	REJECT	MARK
(c)	(i)	<p>Amount hydrogen peroxide produced = $\frac{3.09}{34} = 0.09088$ (moles) (1) Amount of potassium superoxide = 0.09088×2 (moles) (1)</p> <p>mass of potassium superoxide = $0.09088 \times 2 \times 71$ = 12.9g (1) / 13g incl unit but ignore S.F. (note = 6.45 g scores 2 marks)</p> <p>Correct answer with some working scores 3 marks</p>	<p>34g of H₂O₂ requires 2 x 71g of KO₂ (1) 3.09g requires $\frac{2 \times 71 \times 3.09}{34}$ (1) or (2) if this is start line =12.9g (1)</p> <p>If round 0.09088 to 0.09 can score 2 marks for 12.78</p>		(3)
	(ii)	<p>Volume of oxygen = $\frac{3.09 \times 24}{34} = 2.18 \text{ dm}^3$ (1) IGNORE s.f. & do not penalise lack of units twice Allow error carried forward. i.e if omit to x2 in part (i) only penalise it in part (i) not here</p>	2.2		(1)
Question total 9 marks					